

## The Early Stages of *Procris globulariae*, Hb., and of *P. cognata*, H.-S.

By Dr. E. A. COCKAYNE, A.M., F.E.S., and C. N. HAWKINS, F.E.S.

On May 2nd, 1931, we went to Lewes to look for larvae of '*globulariae*.' On the lower slopes of Cliffe Hill the leaves of *Centaurea nigra* showed obvious signs that many larvae had been feeding, but we found only a few. Higher up the hill they were much more plentiful, so that presumably most of those lower down had pupated. We found about 140 larvae, of which all but a few were in the last instar and many were nearly full-fed. Most of them were in blisters of various sizes formed by the cuticle of the leaf all the rest having been eaten; others were in the act of eating their way into a fresh leaf; some with nothing but the head inside, and others with a smaller or larger part of the body already hidden. Larvae only partly inside a leaf dropped to the ground as soon as they were disturbed. Some were cutting a way in from the upper side, but the majority were making a new blister, by entering a leaf from its under side. In one leaf two larvae, both nearly full-grown, were lying side by side in the same blister, but in no other blister was more than one larva found. Three or four larvae were sitting on the central short leaf of the plant, probably full-fed and resting prior to pupation, for they were not changing skin, an operation carried out inside the leaf. Old blisters of all sizes were seen and in many of them the cuticle had turned brown, but not infrequently one was found still showing the shape of the larva that had left it and with the pale green colour of the cuticle unaltered. In such cases a larva was usually found pushing its way in or already inside a neighbouring leaf. Frass was present in strings between the two layers of cuticle in many of the old blisters, for though the larvae extrude some frass, most of it is passed within the blister. The plants of *Centaurea nigra* are very small with the leaves often few in number, short, and rounded so that they are quite inconspicuous, and the discoloured patches left by the larva are often the first thing to draw attention to them. In some of the smaller leaves a blister occupies the major part or even the whole of the leaf. The larvae were surprisingly active, much more so than those of a *Zygaena*, rolling themselves into a ball when disturbed and falling, but soon crawling away to a better shelter if exposed to view.

Expecting a green larva we were surprised when the first larva was seen to be greyish-brown and still more so when at the end of the day we had not taken a single green one. Our first surmise as we came home by train was, that two species must occur on the continent both forming blisters in *Centaurea* and that Buckler must have obtained the wrong one for his figures and description, and on looking at his book found that he obtained eggs in the autumn and larvae in the spring from Herr Heinrich Disqué of Speier. Referring to other authorities it was seen that South, Barrett, and even Tutt had been content to copy Buckler and that all gave the colour of the larva as green. The article in Seitz showed that our guess was very nearly correct.

Dr. Karl Jordan in Seitz *Palaearctic Macro-Lepidoptera* Vol. II., p. 8 (1909) says that *Procris cognata*, H.-S., or what he takes to be this

species, is very like *globulariae*, Hb., differing in the imago having longer pectinations to the antennae and in the claspers of the male being narrower and having a long free thorn-like process at the base directed backwards. He goes on to say that it is found in Spain, Italy, France, and the South coast of England, perhaps also in Germany and Austria, and mines in the leaves of *Centaurea*, especially in *C. nigra*. Of *globulariae* he says it is found in all the countries of Europe except the most Northern and that it is not found in England. Meyrick however in his *Revised Handbook* of 1927, though admitting that *globulariae* and *cognata* are distinct, retains the name *globulariae* for the British species. In all probability it will never be possible to decide which name was applied to the species accepted by Jordan as *cognata*, but it will avoid endless confusion if his determination is accepted. Rebel *Berge Schm. Buch*, 9th edition p. 450 (1910) also uses the name *cognata* for the British species.

Freyer, *Neue Beiträge*. (1833), I. 119, Pl. 62, gives a figure and description of the larva of *globulariae*. The figure shows a larva with a greyish-green ground colour, narrow pale yellow dorsal stripe, a row of large black dorsal spots, another lateral row and a red stripe between them, but in the text he says that there is a row of red spots in a light green (hell graun) line. *Globularia vulgaris* is given as the food-plant. Kirby, *European Butterflies and Moths* (1882) Pl. 21, fig. 2a, figures a pale green larva with a narrow pale yellow dorsal line, a row of large black dorsal spots and another row of black subdorsal spots and between them a blackish-green band with a red wart on each somite. His description states that the larva is green with reddish warts and two zigzag straw-coloured lines on the back. He gives *Centaurea scabiosa* as the food-plant. Hoffmann, *Schm. Eur.* (1893) Pl. 9, fig. 15. has a very similar figure, but the ground colour is not so clear a green and the band between the two rows of black spots is a pale bluish-white so that the red warts show much more distinctly. In the text he says "Grau mit rötlichen Warzen und zwei strohgelben, eckig vortrenden Rücklinien." He gives *Centaurea scabiosa* and *Globularia* as food-plants. Spuler, *Schm. Eur.* (1906) uses the same figure. Hoffmann's figure shows the dorsal black spots as a series of triangles occupying the whole of the anterior and outer part of the dorsum of each somite and uniting anteriorly across the mid-line and laterally, while the lateral row of spots forms a continuous band. It seems clear that these authors are all dealing with the same species.

Buckler's figures, and description made from the larvae from Speier on the Rhine are different in many respects. The following comparative account is extracted from Buckler.

"The larva has a green ground colour, the dorsal black spots are rounder and meet neither across the middle line nor laterally, and there is no pale yellow dorsal line shown in the figures or mentioned in the text. The white subdorsal marking inclines to creamy-white, sometimes to yellowish-white, and this is strongly contrasted below by a broadish stripe of dark green." These markings are not mentioned or figured by Freyer, Kirby, and Hoffmann, while Buckler's figures show no red warts and they are not described. If these red warts are the subdorsal tubercles, they are very unlike those of Buckler's larvae, for all the large tubercles in these are green, the dorsal ones being light bluish green set with short fine blackish bristles.

It is not improbable that there are three species of *Procris* with larvae mining in the leaves of *Centaurea*, one with a grey or greenish larva with red warts first described by Schmidt and figured by Freyer, Kirby, Hoffmann and Spuler, another with the bright green larva with red warts figured by Buckler, and third, our British species with a brownish larva, of which I have found no published description or figure.

If the green larvae belong to two species it is probable that a microscopical examination of the skin of blown larvae would show structural differences. The question as to whether they belong to one or two species might be settled by breeding from green larvae with and without red warts and examining the antennae and genitalia of the two lots of imagines.

Although Jordan pointed out more than twenty years ago that the British species is *cognata* and not the much commoner Continental species *globulariae*, he did not mention the larva of either of them, and, with the exception of Meyrick, no British author has taken any notice of Jordan's remarks. Both before and after Seitz published his book all have followed Buckler attributing a green larva to the British species and they have in consequence taken the imago to be *globulariae*, to which this green larva belongs. None of the Sussex collectors, who have been breeding it from time to time for many years, seem to have noticed that the larva they found was quite unlike that described in all our books. It is remarkable that Tutt in his *British Lepidoptera* copied the old mistake. He must have seen that Buckler's larvae came from abroad, but he never tried to confirm Buckler's account by obtaining larvae from Sussex as he could have done quite easily. The description of the early stages contributed by Chapman is probably correct, but unfortunately the source from which the eggs came is not stated.

The following is a description of our British species, *P. cognata*.

LAST INSTAR.—Larva of the shape common to *Procris* and *Zygaena*, short and stout in the middle, tapering greatly at both extremities. Head very small and flat, nearly black. Prothoracic plate dark brown and shining, 1mm. in length, and 1.5mm. in breadth at the widest part. The plate is triangular in shape with the posterior margin forming the base of the triangle and the apex directed forward. The apex however is very sharp pointed and the sides are not straight lines. Commencing from the base, the sides run parallel or nearly parallel to each other and to the long axis of the larva for about one fourth of their length, then they curve sharply inwards, and finally curve gently forwards again for about the last third of their length so as to meet at a very sharp angle at the apex. The base is almost straight or is slightly sinuous. A narrow strip of colourless chitin runs up the middle of the posterior half dividing it into two parts. On each side from the anterior end of the straight part of the lateral margin a line runs inwards and forwards, curving first with a convexity and then with a concavity forwards, and these lines form by their junction a very sharp projection in the mid-line pointing towards the head. The portion of the plate in front of these lines is covered with long light brown setae and that behind is bare. The anterior portion of the prothorax is not covered by the plate, but is quite soft and the

head can be retracted almost entirely within it or can be thrust far forward for the purpose of eating out the parenchyma of a leaf.

Legs black. Ground colour pale greyish-brown (grayish olive—Ridgway), appearing darker on the dorsum between the dorsal and subdorsal tubercles and below these tubercles owing to the greater abundance of black dots with which this part of the skin is studded. At the beginning of an instar the larva appears to be very dark because the dots are then close together, but it becomes paler as they separate with the growth of the skin. There are four rows of large tubercles either pink or avellaneous (Ridgway); the dorsal tubercles oval, set obliquely with the anterior ends close together, so that only a small space is left between them and almost touching one another on the 2nd thoracic; the subdorsal tubercles oval with their long axis lying transversely. These lie in the line of the anterior ends of the dorsal tubercles and extend downwards nearly to the spiracles, which are at the level of their anterior borders. Below the spiracles are the two subspiracular rows of tubercles, smaller and nearly round. There is one tubercle of each row on each somite. Hairs of two kinds arise from each tubercle, short ones varying somewhat in size, sharp, smooth, pale brown with dark brown tips, and much longer ones, white or colourless, divided up into numerous short segments each a little wider at the distal than at the proximal end. Small numbers of both kinds of hair are also present on the lower part of each proleg, but both kinds are smaller than on the tubercles.

Just external to the dorsal tubercles is a fairly broad stripe, whitish, cream-coloured, or clear pale yellow, curving inwards towards the middle line in the intervals between the tubercle of one somite and the next and sometimes running up the sides of each tubercle. In some larvae this stripe is bordered externally at a point opposite each tubercle by a narrow bright red line. Anal plate small and dark brown. Prolegs with brown crochets. Spiracles small, oval, and black.

Seen under high magnification ( $\frac{1}{3}$  objective) the whole of the prothorax excepting the plate is thickly covered with short sharp black spines pointing backwards and similar spines are also present on the dorsum of the second thoracic and there are also a few low down on the lateral aspect of all the somites, some of them on the prolegs. The black dots, seen with a lens on all somites except the first and second thoracic, are small raised round black chitinous plates, from which arise short blunt spines. These plates vary in size. A few have only a single spine, others have three or four, while the largest have a row of about eight around the margin and three or four in the central part. The central spine is longer than the others and vertical, while the rest point obliquely outwards from the centre. These spiny plates are numerous on all parts above the spiracles with the exception of the subdorsal stripe on which they are scanty, but become very sparse at the level of the subspiracular tubercles.

In addition to these spiny plates the skin, except that of the prothorax, is thickly studded with minute raised dots, much smaller and more numerous than the plates, black where the ground colour is brown and white on the subdorsal line.

On each somite from the second thoracic to the eighth abdominal, in the mid-line half way between each pair of dorsal tubercles is a small area, apparently a shallow depression, variable in size and shape,

but as a rule nearly oval. These areas are free from the small black dots and the larger spiny plates and are occupied by flat plates of thickened cuticle, each approximately round and outlined by a very narrow wavy brown line. The average number in each area is about ten, but they vary in number and in size. There is also a lateral row of similar areas, one on either side of each somite at the level of the upper border of the subdorsal tubercles and lying half way between one tubercle and the next. These areas correspond with the flat black plates found in the same situations in the larva of *Zygaena exulans*, on the dorsum of which there are two roughly semicircular ones with posterior ends close together or even touching, and between the subdorsal tubercles a long narrow plate lying at right angles to the long axis of the larva. *Exulans* however has another lateral row of small round plates at the level of the subspiracular tubercles.

The skin is soft and distensible like that of a *Zygaena*, but no oily drops are exuded, as they are from many points on the skin of a *Zygaena*, when it is rolled preparatory to being blown. There appears to be no prothoracic gland. The blood is a rich orange colour like that of all the species of *Zygaena* examined.

PENULTIMATE INSTAR.—In all respects the same, except that no larva with a red line bordering the subdorsal stripe was met with.

COCOON AND PUPA OF PROCRIS COGNATA, H.-S.—When full-fed the larva rests for some time, often as long as three or four days, on the ground or some object such as a stem or leaf of the food-plant. It then buries itself just beneath the surface of the ground, travelling along for a short distance, frequently pushing up the surface of the earth into a little mound above it. Next it spins the grains of earth above it into a kind of cover with strands of soft silk, which may also occasionally be attached to a leaf of the food-plant or other object lying on the earth beneath it thus forming a fragile outer elongated oval cocoon of earth, which is subsequently strengthened by spinning a layer of silk all over the inside. Within this outer cocoon is an inner one formed of soft but fairly tough pale brownish-grey silk (not greenish-white as described by Buckler and Hofmann, but agreeing very nearly with Zeller, who describes it as "braun-grauen"), closely woven and lightly attached to the outer cocoon, with little nodules of pure white silk here and there in the texture. Very rarely a larva will in captivity form its cocoon upon some object just above the surface of the ground, but these cases are probably due to some abnormal circumstance such as disturbance by another larva. Upon emergence of the imago the pupal skin is often withdrawn entirely from the cocoon and left lying loose on the ground, but this is certainly not always the case. Usually the empty pupal skin is left projecting from the cocoon as in *Zygaena*. The dehisced pupa is fairly transparent, very pale brown in colour, and evidently thinly chitinized. At the same time it is of reasonably stout substance and does not usually lose shape badly on emergence of the imago.

The male pupa is 11.5 to 12mm. long and nearly 4mm. wide outside the wings at the widest part, the third abdominal somite, while the female is about 1mm. less in length, but of stouter build, that part of the abdomen not covered by the wings being considerably stouter than in the male. Chapman's description of the pupa under the name *globulariae* as quoted by Tutt in *Brit. Lepidopt.* Vol. I. pp. 412-3,

appears accurate so far as it goes except that the number of "fine brown spinous points" forming the dorsal rows of spines near the anterior margin of the abdominal somites 2 to 9 varies from 10 to 24 on each side in a female and from 8 to 18 in a male according to the width and position of the somite instead of from 14 to 18 as mentioned by Tutt. A few further details can however now be given from an examination of dehisced pupae. The dorsal head-piece is well developed, as long as the prothorax, or even longer, at the sides and shortening towards the centre-line to about one third of that length. Epicranial suture distinct and effective on dehiscence, leaving the dorsal head-piece attached to the prothorax. Prothorax short and of nearly the same length throughout its breadth, but becoming slightly shorter towards the external margins and in the middle. Mesothorax rather more than three times the length of the prothorax at the sides and about four times the length at the mid-line, there being a large backward projection into the area of the meta-thorax. Metathorax comparatively short, about half the length of the meso-thorax at the sides and shortened by nearly half in the middle by the backward projection of the mesothorax. On dehiscence all these parts separate partially from each other and from the abdomen and usually slide over one another to a certain extent, which makes accurate measurement difficult. The dorsal head-piece and prothorax divide completely down the centre-line and the meso-thorax divides nearly but not quite to the posterior margin. With regard to the head parts, the front is placed well forward and there is no visible fronto-clypeal suture. There does however appear to be some trace of a suture between the clypeus and labrum although it is only a faint line. The invaginations for the anterior arms of the tentorium are slit-like and of considerable size. The labial palpi are either not visible at all externally or they are reduced to two minute knobs at the posterior margin of the labrum, probably the former, in which case the labrum appears to extend slightly over the bases of the maxillae. Mandibles are clearly indicated and consist of raised irregularly oval roughened areas at the posterolateral angles of the labrum. The maxillae are long and reach to about the posterior margin of the 6th abdominal somite or a little further, as also do the tarsi of the 3rd pair of legs. The tarsi of the 2nd pair of legs and the antennae are much shorter and reach barely to the posterior margin of the 4th abdominal. The meso-thoracic wings are about 5mm. long in the female and slightly longer in the male. There is one other point about Chapman's description as quoted by Tutt which appears to need correction. He says there is no definite trace of maxillary palpi. In fact there is, just outside the sculptured eye-piece on each side, a curious little knob-like projection, which appears under the microscope and by transmitted light to show distinct signs of segmentation, the apparent number of segments being three, and a basal part extending to the outer angles of the maxillae. There would seem no doubt that these are maxillary palpi.

As Chapman says there is no cremaster nor anal armature of any description nor are there any setae or spines whatever on any part of the pupa, except the dorsal rows of spines on the abdominal somites. The spiracles on the 8th abdominal are placed very far back, almost at the posterior margin of the somite, and are very prominent particularly in the female.

The date of emergence is much influenced by temperature, for from the pupae kept in an unheated room in London, imagines appeared from June 11th to June 18th with the exception of two belated ones; whereas from those taken on June 2nd to Braemar, where the weather was cold, the imagines appeared from June 27th to July 5th. Emergence generally took place in the afternoon.

Only two larvae were parasitized. A single specimen of *Cremastus bellicosus*, Gr., an Ophionine ichneumon was bred from one, and several *Apanteles* (probably *geryonis*, Marshall from the other. Our thanks are due to Mr. Claude Morley, who identified the former, and to Mr. K. G. Blair who identified the latter.

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### Stray Visits to Kerry in Search of Moths.

By CANON G. FOSTER, B.D.

(Concluded from page 4.)

#### NOCTUIDAE.

- Phaetra (Acronicta) rutilicis*, L.—Kells.
- Agrotis segetum*, L.—Blackwater, Oct., 1908.
- A. vestigialis*, Hufn.—Abundant on the flowers of the bent grass, at the Inch sandhills, July, 1905.
- A. corticea*, Hb.—Inch, 1905.
- A. nigricans*, L.—Glenbeigh, August, on ragweed.
- A. tritici*, L.—Abundant at Glenbeigh, on ragweed.
- A. obelisca*, Hb.—Glenbeigh.
- A. strigula*, Thnb.—Glenbeigh.
- Noctua rubi*, View.—Glenbeigh.
- N. xanthographa*, Fb.—Glenbeigh.
- Axylia putris*, L.—Inch, July, 1905.
- Triphaena interjecta*, Hb.—Glenbeigh, abundant on ragweed in August.
- Mamestra persicariae*, L.—One came in to light, June 1928, Valentia; *persicariae* is very scarce in Ireland, and this is the only occasion I have met with it.
- M. brassicae*, L.—Valentia, June, 1928.
- Apamea gemina*, Hb.—Valentia, June, 1928.
- Hadena pisi*, L.—Caterpillar often to be seen on rushes, etc., in August.
- H. nana (dentina ssp.)*.—Sitting on rocks in daytime, Valentia, West cove, June, 1928; also at sea campion by night.
- Apamea oculea*, Gn.—Generally abundant.
- Dianthoecia cucubali*, Fues.—Abundant. Darrynane, June, 1928, also on sea campion at Valentia same date. Here (Strangford) I have never seen it at sea campion; its place is taken by *D. conspersa*, Esp., which I did not see at Valentia, or anywhere in Kerry. *D. cucubali* here keeps to 'ragged robin.'
- D. carpophaga*, Bork.—I have never seen a typical *carpophaga* in Ireland, but *capsophila*, Dup., is abundant on every part of the coast I have worked; e.g., Strangford and Ardglass, Down; Ballintoy, Antrim; Howth, Dublin; Greystones, Wicklow; Valentia and Inch, Kerry. The darkest, and those with the obscurest markings, were from Inch, Kerry, in late July.